BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

(12) UK Patent Application (19) GB (11) 2 309 938 (13) A

(43) Date of A Publication 13.08.1997

(21) Application No 9622282.3

(22) Date of Filing 25.10.1996

(30) Priority Data
(31) 9602471 (32) 07.02.1996 (33) GB

(51) INT CL[6]
B41J 3/407 // B41J 2/325

(52) UK CL (Edition O)
B6F F203

(56) Documents Cited
GB 2194487 A EP 0512168 A1 EP 0367237 A2
US 5070342 A US 4511903 A

(58) Field of Search
UK CL (Edition O) B6F FAM FBH FJH FKD
INT CL[6] B41J 2/315 2/32 2/325 3/407
Online: WPI

(71) Applicant(s)
Esselte N.V.

(Incorporated in Belgium)

PO Box 85, Industriepark-Noord 30,
9100 Sint-Niklaas, Belgium

(72) Inventor(s)
Mathew Richard Palmer

(74) Agent and/or Address for Service
Page White & Farrer
54 Doughty Street, LONDON, WC1N 2LS,
United Kingdom

(54) Tape printing apparatus

(57) A tape printing apparatus is disclosed having a receiving bay (40) which receives a supply of image receiving tape (54), the image receiving tape (54) being of a first type or of a second, different type. A thermal printhead (42) prints an image on the image receiving tape (54). Control means (see Fig. 3) are provided for controlling the operation of the printhead (42). The control means are operable to activate printing elements of the printhead (42) in accordance with print information defining the image to be printed, the print information comprising a plurality of groups of data to be printed sequentially on a group by group basis, the control means being operable to control the printhead to have a first mode of operation if the image receiving tape is of the first type in which the printing elements are activated a first predetermined number of times for each group of data. The control means also has a second mode of operation in which, if the image receiving tape (54) is of the second type, the printing elements are activated a second predetermined number of times for each group of data, the first predetermined number differing from the second predetermined number.

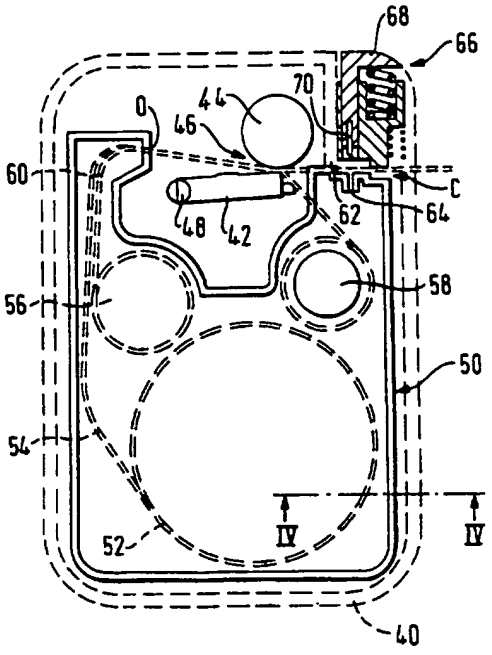

FIG. 2

GB 2 309 938 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

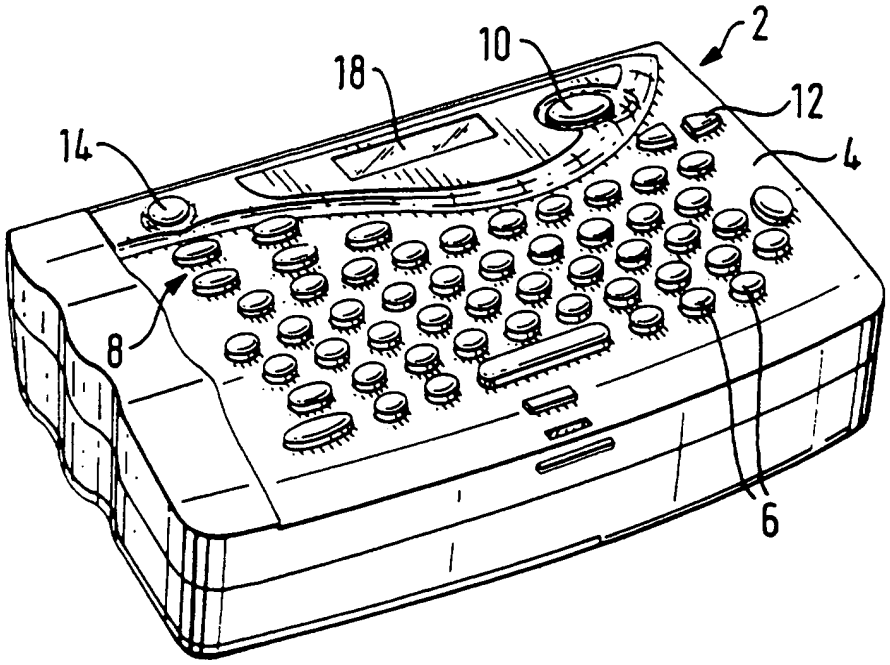

FIG. 1

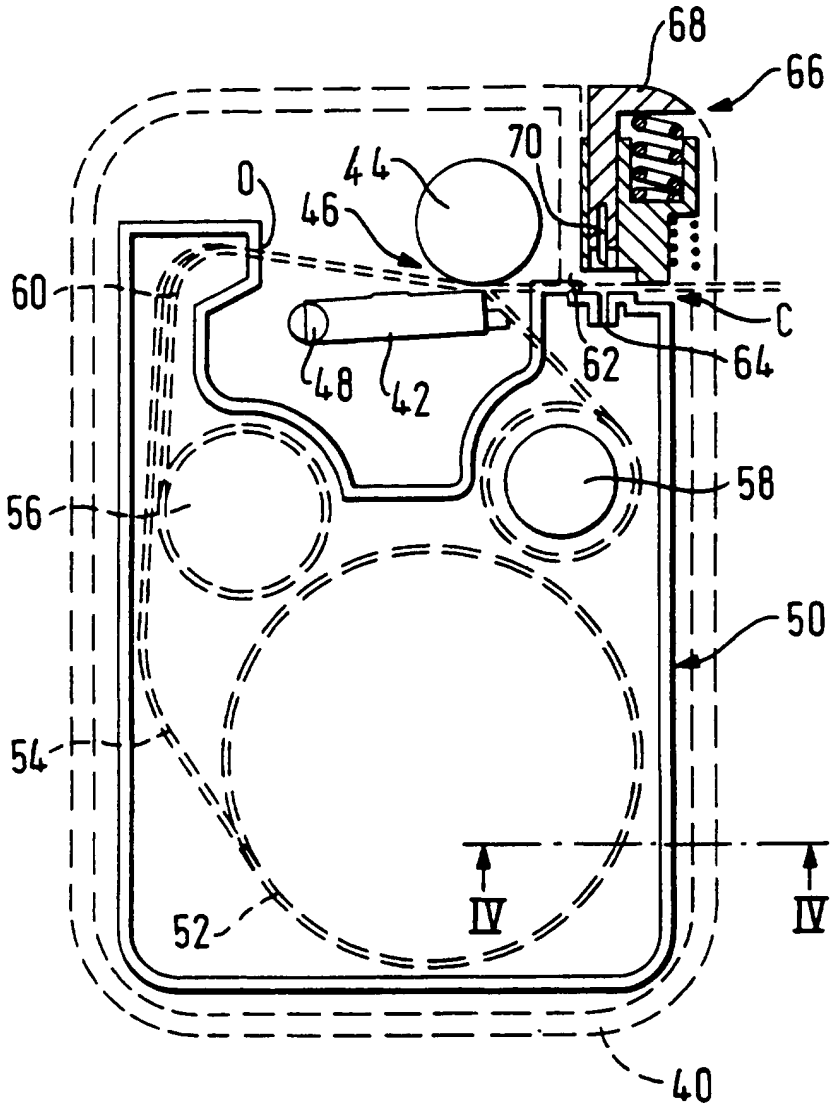

FIG. 2

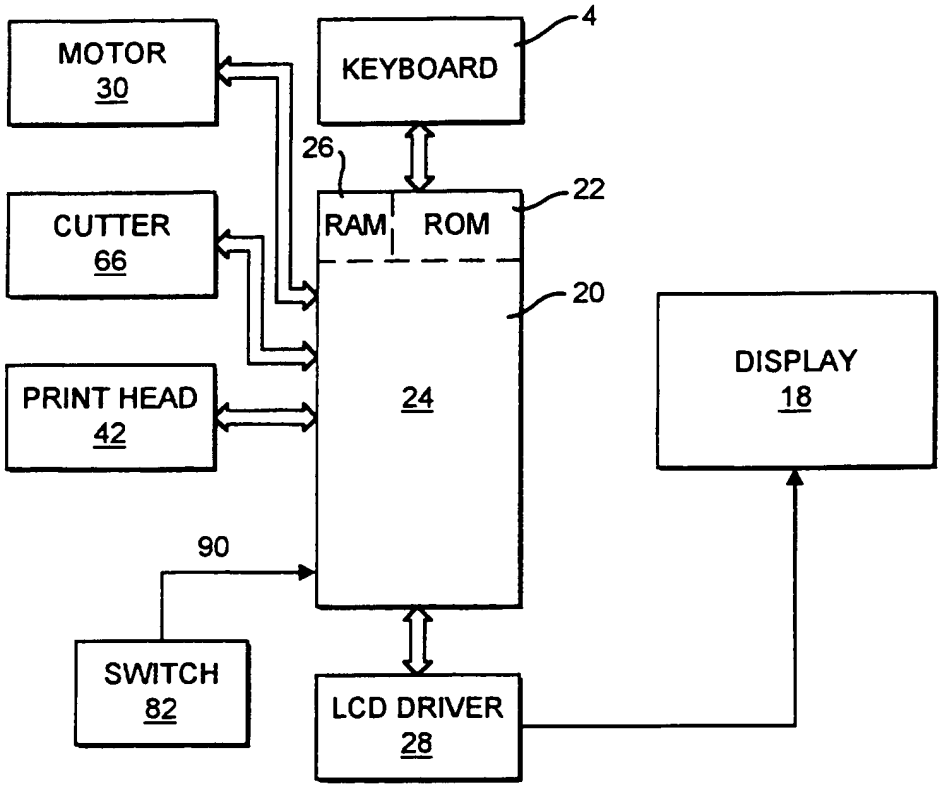
MOTOR
30
KEYBOARD
4
26
22
CUTTER
66
RAM
ROM
20
PRINT HEAD
42
24
DISPLAY
18
90
SWITCH
82
LCD DRIVER
28

FIG. 3

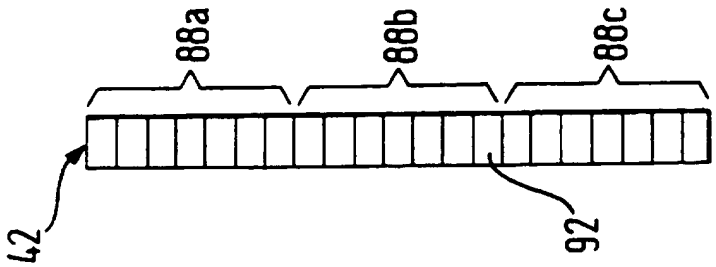

FIG. 7

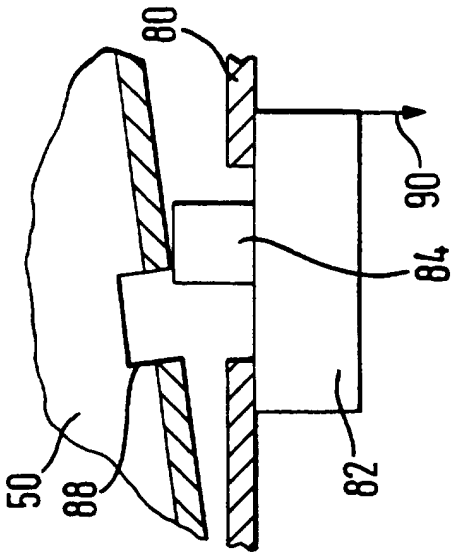

FIG. 5

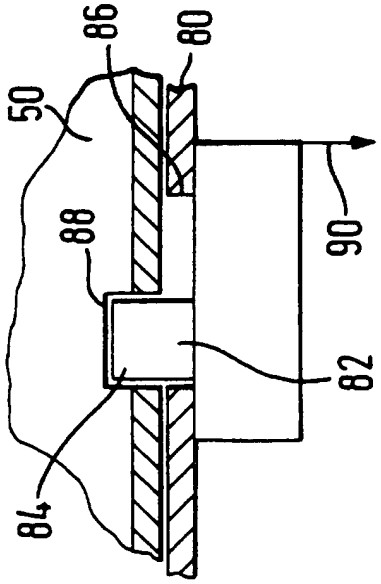

FIG. 4

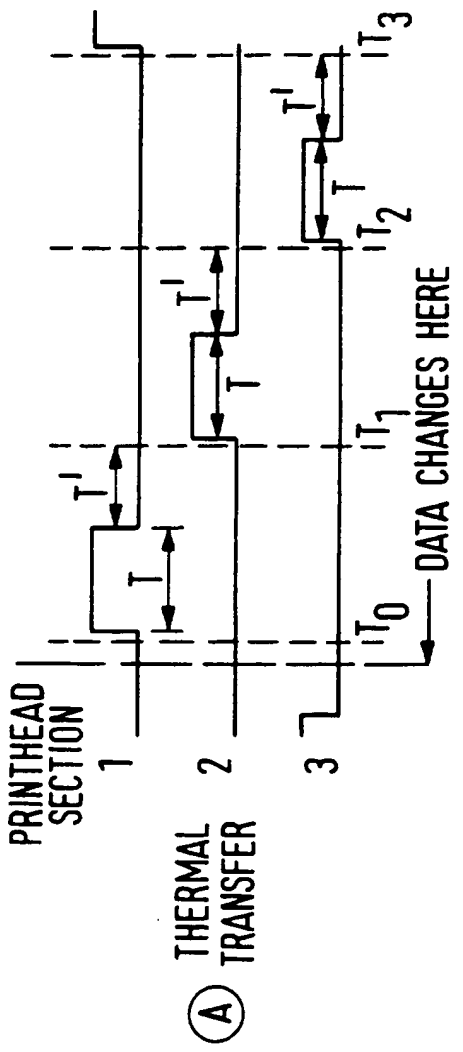
PRINTHEAD SECTION
1
2
3
Ⓐ THERMAL TRANSFER
T'
T
T'
T
T'
T
T_0
T_1
T_2
T_3
DATA CHANGES HERE
SEQUENCE REPEATS

FIG. 6A

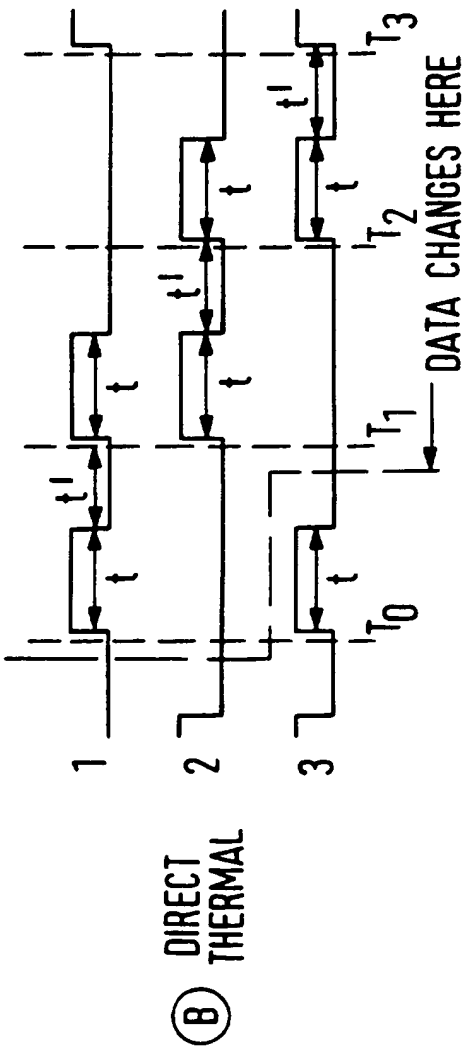
1
2
3
Ⓑ DIRECT THERMAL
t'
t
t'
t
t'
t
T_0
T_1
T_2
T_3
DATA CHANGES HERE

FIG. 6B

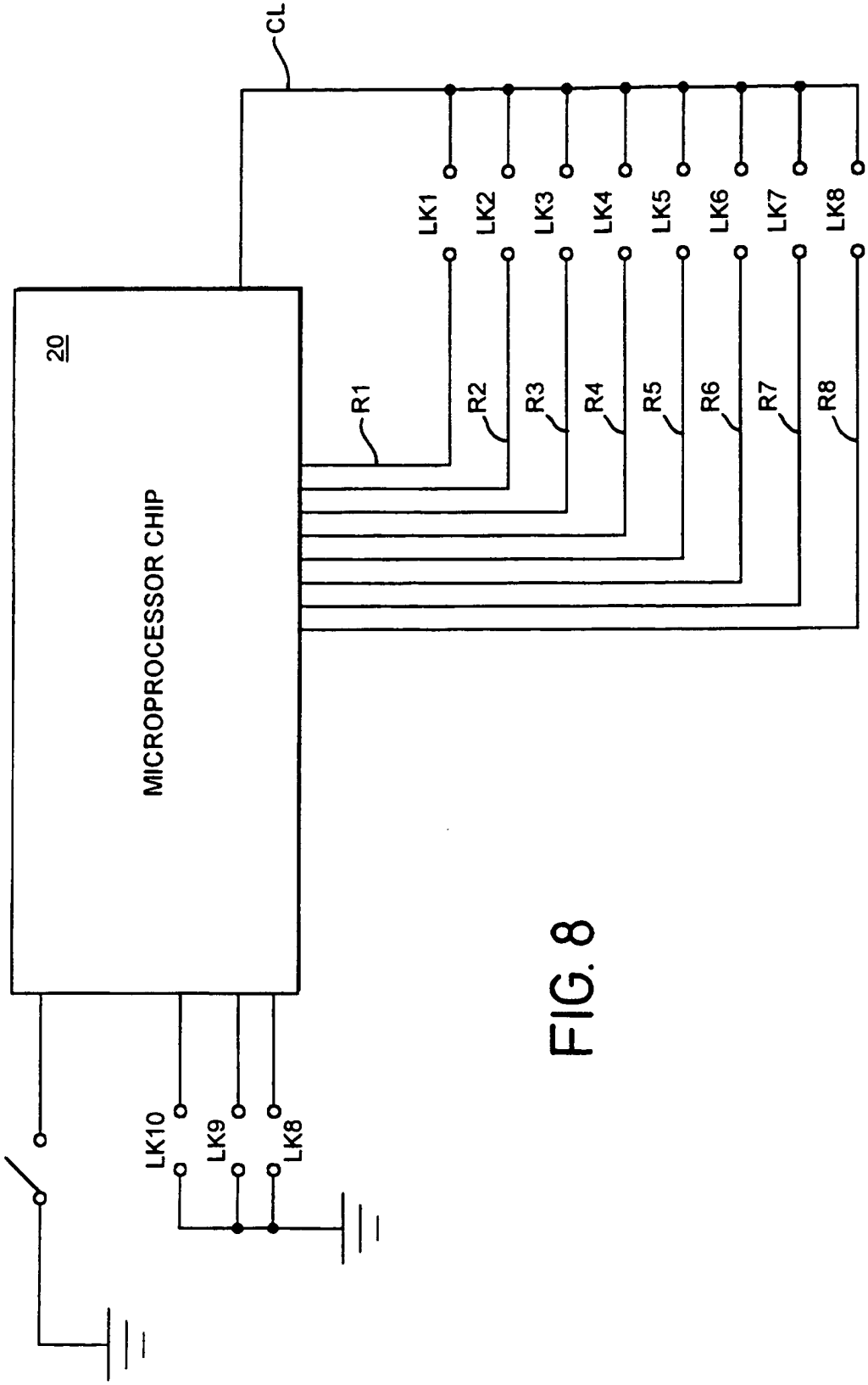
CL
LK1
LK2
LK3
LK4
LK5
LK6
LK7
LK8
20
MICROPROCESSOR CHIP
R1
R2
R3
R4
R5
R6
R7
R8
LK10
LK9
LK8

FIG. 8

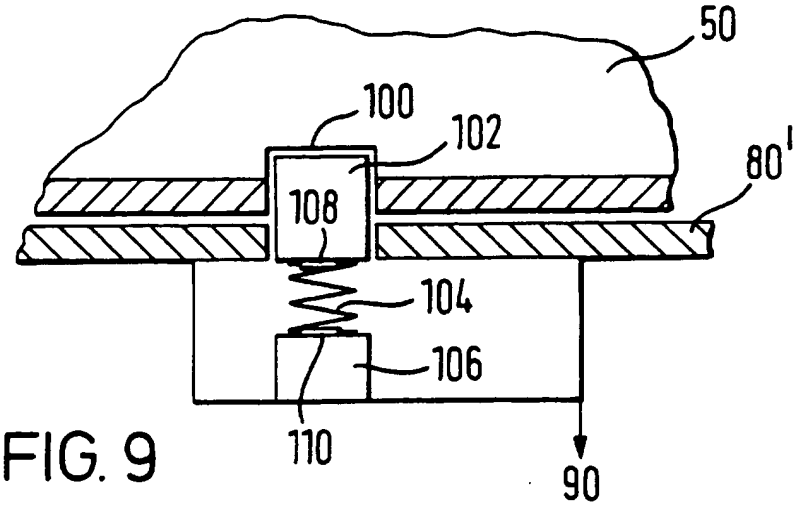

FIG. 9

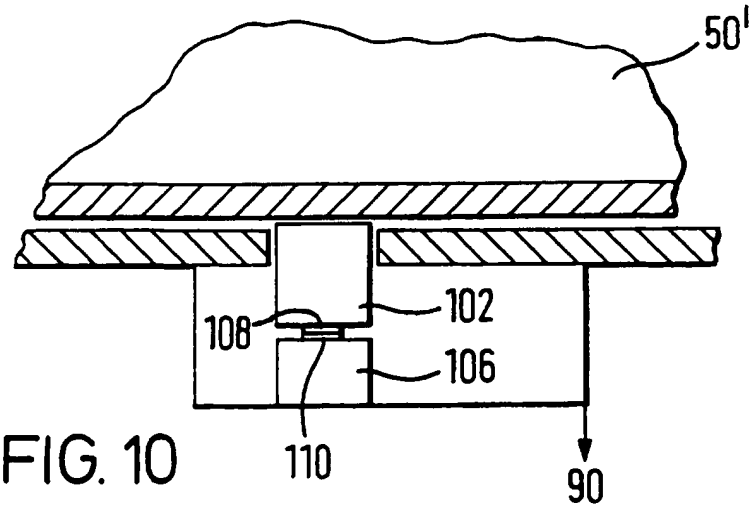

FIG. 10

PRINTING APPARATUS

The present invention relates to a printing apparatus and, in particular but not exclusively, is concerned with tape printing apparatus.

Known tape printing apparatus of the type with which the present invention is generally concerned are disclosed in EP-A-322918 and EP-A-322919 (Brother Kogyo Kabushiki Kaisha) and EP-A-267890 (Varitronics). The printing apparatus generally has a cassette receiving bay for receiving a cassette or tape holding case. In EP-A-0267890, the tape holding case houses an ink ribbon and a substrate tape, the latter comprising an upper image receiving layer secured to a backing layer by an adhesive. In EP-A-322918 and EP-A-322919, the tape holding case houses an ink ribbon, a transparent image receiving tape and a double-sided adhesive tape which is secured at one of its adhesive coated sides to the image receiving tape after printing and which has a backing layer peelable from its other adhesive coated side. With both of these apparatus, the image transfer medium (ink ribbon) and the image receiving tape (substrate tape) are in the same cassette.

The present applicants have devised a different type of tape printing apparatus which is, for example, described in EP-A-578372, the contents of which are herein incorporated by reference. In this tape printing apparatus, the substrate tape is similar to that described in EP-A-0267890 but is housed in its own tape holding case while the ink ribbon is similarly housed in its own tape holding case.

Tape printing apparatus of this type generally also include a display and an input means such as a keyboard for inputting characters to be printed. The input characters are displayed on the display means and in this way a user can compose a label to be printed. When a label has been composed, a print instruction is given and the tape printing apparatus proceeds to

print a label. This type of tape printing apparatus generally also includes a cutter for separating the image receiving tape on which an image has been printed from the supply of image receiving tape, to thereby define a label.

Generally, the image receiving tape passes in overlap with the ink ribbon to a print zone consisting of a fixed print head and a platen against which the print head can be pressed to cause an image to transfer from the ink ribbon to the image receiving tape. There are many ways of doing this, including dry lettering or dry film impression, but the most usual way at present is by thermal printing where the print head is heated and the heat causes ink from the ink ribbon to be transferred to the image receiving tape. The thermal print head generally comprises a single column of printing elements which extend generally widthwise of the image receiving tape, perpendicular to the longitudinal length of the tape. Those printing elements which are activated define pixels on the image receiving tape. It is also known to apply an image directly to a thermally sensitive image receiving tape by selective heating of the print head. This method does not require an ink ribbon to obtain an image on the image receiving tape. This type of printing is generally referred to as direct thermal printing. Thermal printing which requires an ink ribbon is generally referred to as indirect thermal printing or thermal transfer printing.

Known tape printing apparatus are generally arranged either to carry out a direct thermal printing or an indirect thermal printing process, but not both. This is because the print head has different operating parameters depending on the type of printing process selected. It is therefore an object of certain embodiments of the present invention to provide a tape printing apparatus in which the print head can be operated in more than one way so that the tape printing apparatus is capable of printing in more than one mode, for example in an indirect thermal printing mode and a direct thermal printing mode.

According to a first aspect of the present invention, there is provided a tape printing apparatus for printing an image on an image receiving tape comprising:

means for receiving a supply of image receiving tape, said image receiving tape being of a first type or of a second, different type;

a thermal print head for printing an image on said image receiving tape; and

control means for controlling the operation of said print head, said control means being operable to activate printing elements of said print head in accordance with print information defining the image to be printed, said print information comprising a plurality of groups of data to be printed sequentially on a group-by-group basis, said control means being operable to control the print head to have a first mode of operation, if said image receiving tape is of the first type, in which the printing elements are activated a first predetermined number of times for each group of data and a second mode of operation, if the image receiving tape is of the second type, in which the printing elements are activated a second predetermined number of times for each group of data, the first predetermined number differing from the second predetermined number.

By controlling the print head to have a first mode of operation in which the printing elements of print head are activated the first number of times for each group of print information and a second, different mode of operation in which the printing elements are activated a second number of times for each group of print information, it is possible to print successfully on two types of image receiving tape having different print head energy requirements. For example, the first number of times may be one and the second number of times may be two. By activating the printing elements twice for each group of print information, effectively the amount of energy applied by the print head to the image receiving tape for a given group of print information is increased as compared to the case where the printing elements are activated only once for each group of

print information. It is thus possible to provide a tape printing apparatus which is versatile enough to be used successfully with more than one type of tape material.

The groups of print information are printed adjacent one another on the image receiving tape. It should be appreciated that in some embodiments of the invention, the print head has two or more sections which are activated at different times. In these embodiments, a group of print information would define the state of the printing elements of the section of the print head which is to be activated at a given time.

It is preferred that one of said first and second types of tape is of a type to which an image can be directly applied by said print head and the other of said tape types is of the type to which an image can be applied using an image transfer medium. Thus, embodiments of the present invention can be used with image receiving tapes requiring direct and indirect thermal printing methods. Preferably, said first type of image receiving tape is of the type to which an image can be applied using an image transfer medium and the second type of image receiving tape is of the type to which an image can be directly applied. The mode of operation requiring the higher number of activations of the printing elements for a given group of print information can thus be used with direct thermal materials which have a higher print head energy requirement. The mode of operation requiring the lower number of activations of the printing elements for a given group of print information can be used with an indirect thermal material having a lower print head energy requirement. However, it should be appreciated that not all direct thermal materials have a higher print head requirement. Some indirect thermal materials may have a higher print head requirement than some direct thermal materials. Thus, the effective time for which the printing elements are activated for each group of print information can be increased by increasing the number of times that the printing elements are activated for each group of print information. This in turn, means that the amount of energy

applied by the print head for each group of print information is increased. By activating the printing elements of the print head more than once for each group of print information, the tape printing apparatus embodying the present invention may perform better than an apparatus in which the length of time for which the printing elements are activated for each group of print information is increased as compared to an alternate mode of operation. The disadvantage of this latter arrangement is that a higher print head temperature results. This may decrease the reliability of the print head and reduce the quality of print obtained. Further, by activating the print head more than once for a given group of information, it is possible for the tape to move relative to the print head between subsequent activations of the printing elements for the same group of print information. As will be discussed later, this can reduce the appearance of unwanted gaps between adjacent pixels in the printed image.

The print head is preferably activated in pulses, with the first number of activation pulses being provided for each group of print information in said first mode and the second number of activation pulses being provided for each group of print information in said second mode. The control means may define the length of said pulses whereby the length of each pulse in said first mode of operation is different from the length of each pulse in said second mode of operation. By activating the print head in pulses, the drain on the power source can be reduced. This can be important for those tape printing apparatus where the power source is in the form of batteries.

In one preferred mode of operation said print head is activated in pulses, with a double activation pulse being provided for each group of data in the first mode of operation and four activation pulses being provided for each group of data in said second mode.

The length of each activation pulse of the print head may be longer in the second mode of operation than in the first mode

of operation. Alternatively, in some embodiments of the present invention, the activation pulses in the first and second modes of operation may be the same or shorter in the second mode of operation as compared to the first.

The lengths of the pulses used in the first and/or second modes may be selected in accordance with the properties of the two types of image receiving tape used with the printing apparatus and/or characteristics of the tape printing apparatus itself. For example, the pulse length in one or both of said modes can be selected depending on the resistance of the print head. As the print head resistance varies from print head to print head the pulse length in the first and/or second modes can be selected to compensate for variations in the print head resistance so that it is possible to produce tape printing apparatus of the same type which provide the same quality of print.

The image receiving tape is preferably moved relative to the print head between successive activations of printing elements of the print head. By moving the image receiving tape between successive activations of the printing elements of the print head for a given group of print information, it has been found that gaps between the pixel defined by the activation of the printing elements of the print head for one group of data and the pixel defined by the activation of the print head for a second group of data can be avoided. This has been found to be particularly advantageous with metallic direct thermal image receiving tape. It is preferred that the image receiving tape is moved relative to said print head, between said successive activations of printing elements of said print head for a given group of print information by a distance of between 10 to 35% and preferably 25% of the pitch of the pixels printed on said image receiving tape, said pitch of the pixel being measured in the direction of movement of the tape.

A dc motor is preferably provided for continuously moving image receiving tape relative to the print head. It has been found in some embodiments that the use of a dc motor which continuously moves the image receiving tape past the print head gives a better quality of print where the printing elements are activated more than once for a given group of data than if a stepper motor is used which moves the image receiving tape stepwise past the print head. This is because unwanted gaps between adjacent pixels in the printed image may be prevented or at least reduced if the image receiving tape moves continuously past the print head. However, in certain embodiments of the present invention, a stepper motor may nevertheless be appropriate.

Preferably, means for monitoring the speed of the motor are provided, said monitoring means being connected to said control means to control the sequential printing of said groups of print information in dependence on the speed of rotation of the motor.

There are preferably provided selecting means for selecting a value or values for the length of said pulse in said first and/or second mode of operation from a range of possible values for the length of said pulses, said selecting means being coupled to said control means which is operable to control the operation of said print head such that printing elements of the print head are activated for the selected pulse length in the first and/or second modes of operation. The length of said pulses can be preselected in the factory so that the tape printing apparatus has the optimum pulse lengths for the two modes of operation depending on the characteristics of the image receiving tapes to be used with the tape printing apparatus. Additionally, the pulse lengths can also be varied from tape printing apparatus to tape printing apparatus in dependence on inherent characteristics of the components of the tape printing apparatus. For example, the resistance of a print head varies from print head to print head and the pulse length for the first and/or second modes of operation can be selected to reflect the particular resistance

of the print head so that tape printing apparatus of the same type operate in the same or a similar manner.

The selecting means preferably comprises a plurality of open circuit links, at least one of said links being short circuited, wherein each possible selection of one or more short circuited links is representative of a value for the pulse length for the first and/ or second mode of operation. The links are preferably provided between the existing rows or columns of a matrix of a keyboard for inputting an image to be printed on said image receiving tape and an additional dedicated column or row line intersecting said existing rows or columns. In this way, it is possible to provide a number of different possible values for the pulse length or lengths selected for the first and/or second mode of operation without having to unnecessarily increase the number of inputs to the control means, which generally is in the form of a microprocessor chip. In particular, only one additional input is required in order to provide, for example eight different possibilities for a pulse length in either or both of the modes of operation.

In one preferred embodiment of the present invention, the selecting means are operable to select a first value for the pulse length in the first mode of operation and to set separately a second value for the length of the pulse in the second mode of operation. Preferably, one of the pulse lengths is set in dependence on the pulse length used in the other mode. This makes the implementation of the means for setting the pulse lengths simpler. For example, the pulse length in one mode could be defined in terms of a percentage of the pulse length in the other mode.

Switch means are preferably provided for switching between the modes and the switch means is operable to provide a signal to the control means to indicate whether the print head is to be controlled to have the first mode of operation or the second mode of operation.

The switch means may be provided in said means for receiving the supply of image receiving tape, said switch means having one position when the image receiving tape is of one type and a second position when the tape is of the second type. The switch means may be manually operated by the user of the tape printing apparatus or alternatively, may be automatically operated on insertion of said supply of image receiving tape. The switch means need not of course be arranged in the means for receiving the supply of image receiving tape and may be provided at any suitable location of the tape printing apparatus.

According to a second aspect of the present invention, there is provided a tape printing apparatus for printing an image on an image receiving tape comprising:

means for receiving a supply of image receiving tape, said image receiving tape being of a first type of material to which an image can be directly applied by a thermal print head or a second type of material to which an image can be applied by the thermal print head using an image transfer medium;

a thermal print head for printing an image on said image receiving tape; and

control means for controlling the operation of said print head, wherein said thermal print head has a first mode of operation when said image receiving tape is of the first type of material and a second, different mode of operation when said image receiving tape is of the second type of material.

According to the third aspect of the present invention, there is provided a method of printing an image on an image receiving tape comprising the steps of:

inputting data defining an image to be printed on said image receiving tape;

generating print information to control a print head from said input data, said print information comprising a plurality of groups of data, said print head having a plurality of printing elements;

passing said groups of data sequentially to said print head;

and

printing said groups of data adjacent one another on said image receiving tape, wherein the printing elements of the print head are activated a first predetermined number of times for each group of data, if the image receiving tape is of a first type and, if the image receiving tape is of a second type, the printing elements are activated a second, different predetermined number of times for each group of data.

For a better understanding of the present invention and as to how the same may be carried into effect, reference will now be made by way of example to the accompanying drawings in which:

Figure 1 is a plan view showing the front of a tape printing apparatus;

Figure 2 is a plan view of the underside of the tape printing apparatus of Figure 1;

Figure 3 is a simplified block diagram of control circuitry for controlling the tape printing apparatus of Figure 1;

Figure 4 and Figure 5 are partial sections along line IV-IV illustrating a selection switch for selecting a direct thermal or an indirect thermal printing mode;

Figure 6A shows the strobe pulse timing for a print head of the tape printing apparatus of Figures 1 and 2 in an indirect thermal printing mode;

Figure 6B shows the strobe pulse timing for the print head in a direct thermal printing mode;

Figure 7 is a schematic view of a print head used in embodiments of the present invention;

Figure 8 is a schematic view of the microprocessor chip shown in Figure 3 which shows selected inputs for determining the length of the strobe pulses of the print head; and

Figures 9 and 10 show an alternative direct/indirect thermal printing mode selection switch.

Figure 1 shows a simplified plan view of a tape printing apparatus 2. The tape printing apparatus comprises a keyboard

4. The keyboard 4 has a plurality of data entry keys and in particular comprises a plurality of numbered, lettered and punctuation keys 6 for inputting data to be printed as a label and function keys 8 for editing the input data. These function keys 8 are arranged for example to change the size or font of the input data. The keyboard 4 also comprises a print key 10 which is operated when it is desired that a label be printed as well as tape feeding keys 12.

The tape printing apparatus 2 also has a liquid crystal display (LCD) 18 which displays the data as it is entered. The display 18 allows the user to view all or part of the label to be printed which facilitates the editing of the label prior to its printing. Additionally, the display can also display messages to the user, for example error messages or an indication that the print key should be pressed. The display 18 is driven by a display driver 28 which can be seen in Figure 3.

On the underside of the tape printing apparatus 2 which can be seen from Figure 2, there is a cassette receiving bay 40. The cassette receiving bay 40 includes a thermal print head 42 and a platen 44 which cooperate to define a print zone 46. The print head 42 is pivotable about a pivot point 48 so that it can be brought into contact with the platen 44 for printing and moved away from the platen 44 to enable a cassette to be removed and replaced. The cassette inserted into the cassette bay 40 is denoted generally by reference numeral 50. The cassette shown in Figure 2 is suitable for use in an indirect thermal printing mode. The cassette 50 holds a supply spool 52 of image receiving tape 54. The image receiving tape 54 comprises an upper layer for receiving a printed image on one of its surfaces and has on its other surface an adhesive layer to which is secured a releasable backing layer. The image receiving tape 54 is guided by a guide mechanism (not shown) through the cassette 50, out of the cassette 50 through an outlet O, past the print zone 46 to a cutting location C. The same cassette 50 also has an ink ribbon supply spool 56 holding a supply of ink ribbon 60 and an

ink ribbon take up spool 58. The image receiving tape 54 and the ink ribbon 60 are arranged to pass in overlap between the print head 42 and the platen 44. In particular, the image receiving layer of the image receiving tape 54 is in contact with the ink ribbon 60 and during printing a portion of the ink ribbon 60 is in contact with the print head 42 so an image can be applied to the image receiving tape 54.

In this embodiment, the cassette shown in Figure 2 may be replaced by a cassette which only contains a direct thermal image receiving tape. Such a cassette would have a similar construction to that shown in Figure 2 although the ink ribbon 60 would be omitted. An image would then be printed directly by the print head 42 onto the image receiving tape 54.

The platen 44 is driven by a motor 30 (see Figure 3) preferably a dc motor as will be discussed below. However, in certain embodiments, a stepper motor can be used. The platen 44 is driven by the motor so that it rotates to drive the image receiving tape 54 in a direction which is parallel to the lengthwise extent of the image receiving tape 54 through the print zone 46. In this way, an image is printed on the image receiving tape 54 and the image receiving tape 54 is fed from the print zone 46 to the cutting location C. The cutting location C is provided at a location on a portion of the wall of the cassette 50 which is close to the print zone 46. The portion of the wall of the cassette where the cutting location C is defined is denoted by reference 62. A slot 64 is defined at the wall portion 62 and the image receiving tape 54 is fed past the print zone 46 to the cutting location where it is supported by facing wall portions on either side of the slot 64.

A cutting mechanism 66 is provided which includes a cutter support member 68 which carries a blade 70. The blade 70 cuts the image receiving tape 54 and enters the slot 64. The cutting mechanism 66 thus separates the image receiving tape 54 on which an image has been printed from the supply of image receiving tape

54 in the cassette 50 to thereby define a label.

The print head 42 is a thermal print head comprising a column of a plurality of printing elements. Each printing element may be square or rectangular. In one embodiment, the print head 42 is provided with 128 printing elements. The print head 42 is preferably only one printing element wide and the column extends perpendicular to the lengthwise extent of the image receiving tape 54. The height of the column of printing elements is preferably equal to or slightly less than the width of the image receiving tape 54 to be used with the tape printing apparatus 2. Where more than one width of image receiving tape 54 is used, the print head column will generally have a height corresponding to the largest width of image receiving tape 54. An image is printed on the image receiving tape 54 column by column by the print head 42. The image can be printed on the image receiving tape 54 via the ink ribbon 60, in an indirect thermal printing mode. However, if the image receiving tape 54 is a thermally sensitive material, an image can be applied directly by the print head 42 to the image receiving tape 54 in a direct thermal printing mode. However, this will be discussed in more detail hereinafter.

As an alternative to the one cassette system shown in Figure 2, the cassette receiving bay may be arranged to receive a separate image receiving tape cassette and a separate ink ribbon cassette which are arranged so that the ink ribbon and image receiving tape are passed in overlap through the print zone. This particular cassette arrangement is described for example in our earlier European Patent Application No. 578372, the contents of which are herein incorporated by reference. When this modified tape printing apparatus is arranged to print in a direct thermal mode, only a single cassette containing the direct thermal image receiving tape need be inserted into the cassette receiving bay 40.

It should be appreciated that any other suitable arrangement

for providing a supply of image receiving tape and a supply of ink ribbon, when required, can of course be used in embodiments of the present invention.

Figure 3 shows the basic control circuitry for controlling the tape printing apparatus 2 of Figures 1 and 2. There is a microprocessor chip 20 having a read only memory (ROM) 22, a microprocessor 24, and random access memory capacity indicated diagrammatically by RAM 26. The ROM 22 stores data defining the characters and/or symbols which can be selected via the keyboard 4. Additionally, the ROM 22 may also store various algorithms. For example, an algorithm for reconstructing the font data may be stored where data compression techniques have been used and/or sizing or print style algorithms may be stored so that print information for the desired size and/or style of characters etc can be generated.

The microprocessor 24 is controlled by programming stored in the ROM 22 and when so controlled acts as a controller. The microprocessor chip 20 is connected to receive label data input to it from the keyboard 4. The microprocessor chip 20 outputs data to drive the display 18 via the display driver 28 to display a label to be printed (or a part thereof) and/or a message or instructions for the user. It should be appreciated that in certain embodiments of the present invention, the display driver may form an integral part of the microprocessor chip 20. Additionally, the microprocessor chip 20 also outputs data to drive the print head 42 which prints an image onto the image receiving tape 54 to form a label. The microprocessor chip 20 also receives an input 90 which indicates whether the tape printing apparatus is to operate in the direct thermal printing mode or the indirect thermal printing mode. As will be described later, this input may be connected to a switch having one position when the direct thermal printing mode is to be selected and a different position when the indirect thermal printing mode is to be selected.

In particular, the microprocessor chip 20 is arranged to generate print information to control the operation of the print head 42. This print information is generated from the data input by the user via the keyboard 4 in accordance with the data stored in the ROM 22 and any stored algorithms. In particular, when a key of the keyboard is depressed, data concerning the associated character etc is retrieved from the ROM 22 and then stored in the RAM 26. This data is then manipulated to define the print information. This manipulation may involve the application of one or more stored algorithms. This print information comprises a plurality of groups of print information. Each group of print information corresponds to a column of data. These columns of data are applied in succession to the print head 42. As will be described hereinafter in more detail, each column of data is supplied to the print head only once when the tape printing apparatus 2 is in the indirect thermal printing mode and each column of data is applied twice to the print head 42 when in the direct thermal mode. Each column of data defines the status of each printing element in the print head 42, i.e. whether each printing element is on or off. In some embodiments, as described hereinafter, the print head is divided into three sections. In that case, each group of print information would relate to one section of the print head only.

Finally, the microprocessor chip 20 also controls the motor 30 for driving the image receiving tape 54 through the tape printing apparatus 2. The microprocessor chip 20 may also control the cutting mechanism 66 to allow lengths of image receiving tape 54 to be cut off after an image has been printed thereon to define labels. Alternatively, the cutting mechanism may be manually operable by the user.

As indicated above, the tape printing apparatus 2 is arranged to print in a direct thermal mode and an indirect thermal mode. As will be discussed hereinafter, the print head 42 operates differently depending on whether the tape printing apparatus 2 is in the indirect or direct thermal printing mode.

Reference will now be made to Figures 4 and 5 which illustrate how a user of the tape printing apparatus can select the desired mode, that is the indirect thermal printing mode or the direct thermal printing mode.

Figure 4 shows a partial diagrammatic section along line 44 in Figure 2. In Figure 4, reference numeral 80 denotes the floor of the cassette receiving bay 40. Reference numeral 50 denotes a cassette of the type shown in Figure 2 which contains an image receiving tape 54 as well as an ink ribbon 60. In other words, such a cassette is suitable for use in an indirect thermal printing mode. Reference numeral 82 denotes a switch and reference numeral 84 denotes an actuating part of the switch 82. The switch 82 can be a standard low cost two position slide switch, conveniently mounted below the cassette bay floor 80, so that the actuating part 84 protrudes above the cassette bay floor 80 through a slot 86. The actuating part 84 of the switch 82 is shown in a first position in Figure 4. This position is the indirect thermal printing mode position. The cassette 50 holding the image receiving tape 54 and the ink ribbon 60 has a recess 88 in its underside which is located to accommodate the actuating part 84 of the switch 82 when it is in the indirect thermal printing mode position. The switch 82 is connected to the microprocessor chip 20 via input 90. This input 90 indicates to the microprocessor chip 20 the position of the actuating part 84 of the switch. The microprocessor chip 20 then uses this information to determine whether the tape printing apparatus 2 is in the direct thermal printing mode or the indirect thermal printing mode.

The actuating part 84 of the switch 82 is movable into a second position which is indicative of the direct thermal printing mode. This is shown in Figure 5. In the direct thermal printing mode position, it is identified that a cassette containing a direct thermal image receiving means is present. Thus, a cassette housing a direct thermal image receiving tape,

and no ink ribbon, would have a recess located in a position to accommodate the actuating part 84 in its direct thermal printing mode position. However, this is not illustrated. Figure 5 does illustrate how the actuating member 84 of the switch 82 prevents an incorrect cassette from being inserted, with reference numeral 50 denoting a cassette as shown in Figure 4 having an image receiving tape 54, and an ink ribbon 60 and a recess 88 in a location intended to accommodate the actuating part 84 in its first position. With this embodiment, it is possible to identify whether or not the tape printing apparatus should operate in the direct thermal or the indirect thermal printing mode and it can also prevent a user from inserting the incorrect type of tape.

It should be appreciated that the arrangement shown in Figures 4 and 5 can be modified so that the recess provided in the bottom of the indirect thermal and the direct thermal cassettes is large enough to accommodate the actuating part 84 of the switch 82, regardless of the position of that switch 82.

The print head 42 is controlled to have two modes of operation, a direct thermal printing mode and an indirect thermal printing mode. The mode of operation of the print head 42 is controlled in accordance with the position of the switch 82. Generally, more energy needs to be applied to an image receiving tape for use in the direct thermal printing mode to form a satisfactory image as compared to an image receiving tape for use in the indirect thermal printing mode. There are a number of factors which can influence the amount of energy which is applied to the image receiving tape by the print head 42. These are as follows:

length of time for which energy is applied by the print head to the image receiving tape 54;

voltage level applied to the print head 42; and

resistance of the print head 42 itself.

The resistance of the print head 42 is an inherent property

of the print head 42 and therefore is not generally alterable. In preferred embodiments of the invention, the length of time for which energy is applied to the print head 42 is altered in dependence on the selected mode of operation of the tape printing apparatus. Reference will now be made to Figures 6A and 6B.

Figure 6A shows the strobe pulse timing for the print head 42 when operated in the indirect thermal printing mode. A strobe pulse is the pulse of energy which is applied to the print head 42 in order to activate selected printing elements of the print head 42 so that an image can be applied to the image receiving tape 54. The printing elements 92 (see Figure 7) are either "on" or "off" as defined by each group of print information. Both in this mode and the direct thermal printing mode, the printing elements of the print head 42 are divided into three sections 88a, 88b and 88c as can be seen from Figure 7. Each section 88a, 88b, 88c of printing elements 92 is generally activated in succession. In the indirect thermal printing mode the maximum number of printing elements 92 of the print head 42 activated at any one time is equal to one third of the total number of printing elements 92. Line 1 of Figure 6A represents the activation or strobe pulse timing of the first section 88a of the print head 42, line 2 represents the activation of the second section 88b of the print head 42 whilst the third line represents activation of the third section 88c of the print head 42.

The printing elements 92 of the first section 88a of the print head 42 which are to be activated in accordance with a group of print information are activated at time T_0 for a time period T. There is then a period of time T' during which none of the printing elements 92 of the whole print head 42 are activated. Next, at time T_1, those printing elements 92 of the second section 88b of the print head 42 which are to be activated in accordance with the next group of print information are activated for a time period T (equal to the time T for which the printing elements 92 of the first section 88a of the print head 42 are activated). Once again, there follows a time period T'

during which none of the printing elements 92 of the entire print head 42 are activated. At time T_2, those printing elements 92 of the third section 88c which are to be activated are activated for a time period T, in accordance with the next group of print information. Following the activation of the printing elements 92 of the third section 88c of the print head 42, there is a period T' during which none of the printing elements 92 of the print head 42 are activated. Thus, the time periods T (or strobe pulse length) for which each section 88a, 88b, 88c of the print head is activated are equal. The length of time T' between successive strobe pulses is generally equal. The cycle is then repeated and the first section 88a of the print head 42 is activated again, in accordance with the next group of print information. Thus, each group of print information is supplied only once to the print head.

As will be described in more detail hereinafter, the length of the activation time period T for strobe pulse length is selected in accordance with the resistance of the print head 42.

Reference will now be made to Figure 6B which shows the strobe pulse timing for the print head 42 when operating in the direct thermal printing mode. In contrast, to the operation of the print head 42 in the indirect thermal printing mode, each section 88a, 88b, 88c of the print head 42 is strobed (or activated) twice in succession for each group of print information. This can be seen particularly clearly from Figure 6B. As will be described in more detail hereinafter, two out of the three sections 88a, 88b, 88c of the print head 42 are strobed or activated at any one time. As with Figure 6A, line 1 represents activation of the first section 88a of the print head 42, line 2 represents the activation of the second section 88b of the print head 42 whilst line 3 represents the activation of the third section 88c of the print head 42.

Referring first to the first section 88a of the print head 42, those printing elements 92 which are to be activated are

activated twice in succession for the same group of print information. Each pulse or activation period lasts for a time period t with a period of time t' between the first and second activations of the selected printing elements 92 of the first section 88a of the print head 42. It should be noted that because each group of print information is supplied twice to the print head 42, exactly the same printing elements 92 of the first section 88a of the print head 42 are activated during the first and second strobe pulses applied to that first section. This is in contrast to the indirect thermal printing mode in which a different group of print information is applied to the given section of the print head 42 in successive activations thereof. The printing elements 92 of the second section 88b of the print head 42 which are to be activated are also activated twice, in succession for each group of print information. The second strobe pulse for the first section 88a coincides with the first strobe pulse for the second section 88b of the print head 42. The two activation periods or strobe pulses for the second section 88b of the print head 42 are each equal in length to the activation periods of the strobe pulses for the first section 88a. Similarly, with the third section 88c of the print head 42, the first activation period or strobe pulse for the third section 88c coincides with the second activation period or strobe pulse for the second section 88b of the print head 42. Once again, the activation periods (strobe pulses) for the third section of the print head are the same length as those of the first and second sections 88a and 88b. The second strobe pulse of the third section 88c coincides with the first strobe pulse of the first section 88a.

It should be noted that the length of the strobe pulses during the direct thermal printing mode may not be the same as that of the strobe pulses during the indirect thermal printing mode. In particular, the activation period (strobe pulse) length during the direct thermal printing mode will generally be longer than that used in the indirect thermal printing mode. However, the relative lengths of the strobe pulses during the two modes

of operation will generally depend on the characteristics of the direct thermal and indirect thermal image receiving tapes used as well as the print head 42, itself.

It is preferred that the image receiving tape 54 be moved between successive strobe pulses, particularly during the direct thermal printing mode. In particular, it is preferred that the tape 54 move by a distance corresponding to between 10 and 35% and preferably, 25% of the printed pixel pitch during the time period between the first and second strobe pulses for a given group of print information for each section 88a, 88b, 88c. In embodiments where the print head is divided into three sections, the movement between successive activation pulses in the direct thermal printing mode may be 33% of the pitch of the printed pixels. By moving this distance in the time interval between the first and second strobe pulses, it can be ensured that there are no gaps between adjacent pixels defined on the image receiving tape 54 unless of course gaps are desired. It is therefore preferred that the motor used be a dc motor 30 which continuously drives the image receiving tape 54 past the print head 42. In this regard, reference is made to our co-pending European application number 94308084.6 the contents of which are herein incorporated by reference.

In the embodiment described hereinbefore, the printing elements of the print head are activated only once for each group of print information whilst in the second mode of operation, the printing elements of the print head are activated twice for each group of print information. However, in an alternative embodiment, the respective number of times which the printing elements are activated for each group of print information can be selected to have any appropriate value. The number of activations of the printing elements for each group of print information will differ in the first and second modes of operation. For example, the printing elements of the print head may be activated twice for each group of data in the first mode of operation whilst in the second mode of operation, the printing

elements are activated four times for each group of data. In this latter embodiment, each printing element may be rectangular so that in the second mode of operation, the four successive activations of the printing elements for the same group of data may define a square pixel on the image receiving tape. Likewise, in the first mode of operation, the two activations of the printing elements for the same group of print information may also cause a square pixel to be defined by the rectangular printing elements. This of course is achieved by selecting the appropriate rectangular shape for each printing element and moving the image receiving tape by an appropriate amount between each successive activation of the printing elements for the same group of print information.

The four successive activations of the printing elements for the same group of data may occur at regularly spaced time intervals. However, in one preferred embodiment, a similar arrangement to that described in relation to Figures 6A and 6B is used. In the first mode of operation which requires each print head section to be activated twice for a given set of print information, the two activation pulses for the same group of information are separated by a time of $3(T+T')$. For example, with the first print head section, the printing elements would be activated at times T_0 and T_3. Thus, the second and third sections of the print head would both be activated between the first and second activations of the first section of the print head for the same print information. Likewise, in the second mode of operation, the first two activations of the first section of the print head, for a given set of data, commences at time T_0. The second two activations, for the same set of print information commences at time T_3. In this way, it is possible to define a square pixel in the printed image from a rectangular printing element in both the first and second modes of operation.

It should be appreciated that the nature of the image receiving tape will affect the size of the printed pixel. Thus, the size of the image printed on a thermal transfer medium may

be larger than that printed on a direct thermal printing medium. The additional print head activations in the second mode of operation is able to compensate for this so that in both the first and second modes of operation, the activation of the print head is able to define a pixel which is generally the same.

In one modification to the present invention, the four successive activations of the printing elements may occur at equally spaced intervals and may have a similar pattern to that shown for example in Figure 6b but with the two adjacent activation periods replaced by four adjacent activation periods. Whilst the modification to the described embodiment has referred to two and four successive activations of each printing element for the same group of print data, any other suitable number of activations can also be used with embodiments of the present invention.

In some embodiments of the present invention, the print head will be provided with its own register for storing one or more groups of print information. In those embodiments, each group of print information would be sent only once to the register of the print head regardless of the number of times that the printing elements are activated for each group of print information. Alternatively, the print head may not have its own register and instead data is passed to the print head from, for example, the microprocessor. In this case, the information will be sent to the print head each time the printing elements of the print head need to be activated.

It is preferred that the dc motor 30 be provided with an encoder (not shown) which monitors the speed of rotation of the motor 30 and is connected to the microprocessor chip 20 to control the activation of the print head 42 in dependence on the speed of rotation of the motor 30. The encoder generally takes the form of a shaft encoder having, for example, a slotted disc arranged to rotate with a shaft of the dc motor 30 and a light source and light detector on opposite sides of the disc. The

microprocessor chip 20 uses signals from the shaft encoder to control the sequential printing of the groups of print information to ensure that adjacent groups of pixels are printed in the correct relationship on the image receiving tape which depends on the speed of the image receiving tape. It has been found that it is possible to obtain a better quality of print if the image receiving tape is driven continuously past the print head and for this reason it is preferred that a dc motor be used. If a stepper motor is used which moves the tape stepwise, then a higher energy may well be required to be applied to the print head during the direct thermal printing mode in order to avoid unwanted gaps between successive pixels in the printed image. However, in some embodiments of the invention, a stepper motor may be used.

Reference will now be made to Figure 8 which illustrates how the length of the strobe pulses are set for the direct thermal printing and indirect thermal printing modes. Some of the parts of the microprocessor chip 2 and inputs thereof have been omitted in the interests of clarity. The microprocessor chip 20 has eight input lines 100. Each of these eight input lines has a link, LK1-8 respectively. Each link corresponds to a possible strobe pulse length. One of these links, and only one in this embodiment, is shorted. In other words, a connection is made between the two terminals of one link using, for example solder. The microprocessor chip 20 is able to determine as described in more detail hereinafter which of the links is shorted and hence the selected strobe pulse length for indirect thermal printing. The table below gives a range of possible strobe time values for use in the indirect thermal printing mode:

Link	Strobe Time (milliseconds)
LK1	2.60
LK2	2.45
LK3	2.30
LK4	2.14

LK5	2.00
LK6	1.87
LK7	1.75
LK8	1.63

The length of the strobe pulse during the indirect thermal printing mode is set in the factory during production of the tape printing apparatus in accordance with the resistance of the print head 42 and also the characteristics of the indirect thermal material. The strobe pulse length will thus not in general be altered by the user. Due to tolerances in the manufacturing process of the print head, not all print heads will have exactly the same resistance. As the resistance of the print head 42 has a material effect on the energy applied by the print head 42 to the image receiving tape 54 during printing, the strobe time can be selected to compensate for the differences in the resistance between different print heads 42. Thus, different samples of the same tape printing apparatus 2 can be produced which operate in a similar or the same way.

It should be noted that in this embodiment, the links LK1-8 are each provided between respective rows of lines R1-8 of a keyboard matrix of the keyboard 4 and an additional column line CL which intersects those row lines R1-8. Thus, when a particular link is shorted, one of the row lines R1-8 of the keyboard matrix is connected to the dedicated additional column line CL. In this regard, reference is made to our co-pending U.K. Patent Application No. 9517439.7, the contents of which are herein incorporated by reference. It can be determined which of the links L1-8 is shorted during the normal scanning of the keyboard matrix which takes place in order to determine which keys are activated.

In particular, the microprocessor chip 20 will sequentially drive signals through each of the lines of the keyboard matrix arranged in columns. It should be noted that only the dedicated column line CL is shown. As a signal is driven on each column

line, the microprocessor chip 20 will interrogate, at the same time, all of the eight rows of the keyboard matrix in order to determine closed intersections. More particularly, when the microprocessor chip 20 drives a signal through the additional column line CL, the microprocessor chip 20 is able to detect which of the row lines R1-8 is receiving the signal. The microprocessor chip 20 is then able to ascertain which of the links L1-8 is closed and accordingly which strobe time has been selected. Thus, the microprocessor chip 20 can ensure that the print head 42 has the most appropriate strobe pulse length for its resistance to provide the required energy levels during the indirect thermal printing mode.

The length of strobe pulse which is used in the direct thermal printing mode is defined in terms of the length of the strobe pulse used in the indirect thermal printing mode. It should be appreciated that the two activation pulses used for each set of print information are the same length, in the direct thermal printing mode. In particular, three additional links, LK9-11 are provided, which are similar to links LK1-8. However, these additional links are not provided as part of the keyboard matrix. Furthermore, more than one of these links can be shorted. Depending on which of these links LK9-11 are shorted, the microprocessor chip 20 is able to determine the length of the strobe pulse during the direct thermal printing mode. The difference between the length of the strobe time during the indirect thermal printing mode and the direct thermal printing mode is defined in terms of numbers of "offset". Each offset corresponds to 7% of the length of the strobe pulse during the indirect thermal printing mode. For example, an offset of +2 represents a strobe pulse of 114% of the strobe pulse length during the indirect thermal printing mode. A table showing the possible offset values for various settings of links LK9-11 is set out below. 0 represents an open link whilst 1 represents a short-circuited link.

LK9	LK10	LK11	Offset
0	0	0	-2

1	0	0	-1
0	1	0	0
1	1	0	+1
0	0	1	+2
1	0	1	+3
0	1	1	+4
1	1	1	+5

The offset, and thus the strobe time for the direct thermal printing mode is selected in accordance with the direct thermal printing material to be used with the tape printing apparatus. Once again, this setting will be done in the factory during the manufacture of the tape printing apparatus and will not usually be altered by the user. It is possible to have a range of different machines which operate with a range of different materials and to modify each machine so that it can optimally operate with the selected direct thermal material. This also has the advantage that the direct thermal material to be used with the tape printing apparatus can be changed without having to make substantial alterations to the manufacturing process for the tape printing apparatus.

Typically, the gap between successive pulses for the same group of information will be around 1.5ms.

Figures 9 and 10 illustrate an alternative way in which the indirect thermal printing mode and the direct thermal printing mode can be selected. Figure 9 shows a diagrammatic section along line IV-IV in Figure 2. In Figure 9, reference numeral 80' denotes the floor of the cassette receiving bay 40 whilst reference numeral 50 denotes a cassette which contains an image receiving tape 54 as well as an ink ribbon 60. The indirect thermal cassette has a recess 100 which is arranged to accommodate a member 102 of a switch. The member 102 is resiliently supported by spring member 104 which biases member 102 away from member 106. In Figure 10, reference numeral 50' denotes a direct thermal cassette containing only an image

receiving tape 54. This cassette 50' does not have a recess and accordingly, the member 102 is pushed downwardly towards member 106. A contact 108 on member 102 is thus in contact with a contact 110 on the member 106. This provides a signal to the microprocessor chip 20 indicating the presence of the direct thermal cassette. In this way, the microprocessor 20 can determine whether a cassette containing a direct thermal or an indirect thermal material is present and accordingly to modify the operation of a print head 42.

It should be appreciated that whilst the preferred embodiment of the invention has been described in the context of a print head with three sections, it should be appreciated that alternative embodiments of the invention may have any other suitable number of sections, for example one or two sections.

The preferred embodiment described may be modified so that the direct thermal printing mode uses only one activation pulse for each group of print information and the indirect thermal printing mode uses two activation pulses for each group of print information. This will depend on the properties of the image receiving tape to be used with the tape printing apparatus.

CLAIMS:

1. A tape printing apparatus for printing an image on an image receiving tape comprising:

means for receiving a supply of image receiving tape, said image receiving tape being of a first type or of a second, different type;

a thermal print head for printing an image on said image receiving tape; and

control means for controlling the operation of said print head, said control means being operable to activate printing elements of said print head in accordance with print information defining the image to be printed, said print information comprising a plurality of groups of data to be printed sequentially on a group-by-group basis, said control means being operable to control the print head to have a first mode of operation, if said image receiving tape is of the first type, in which the printing elements are activated a first predetermined number of times for each group of data and a second mode of operation, if the image receiving tape is of the second type, in which the printing elements are activated a second predetermined number of times for each group of data, the first predetermined number differing from the second predetermined number.

2. A tape printing apparatus as claimed in claim 1, wherein one of said first and second types of tape is of a type to which an image can be directly applied by said print head and the other of said tape types is of the type to which an image can be applied using an image transfer medium.

3. A tape printing apparatus as claimed in claim 1 or 2, wherein said first type of image receiving tape is of the type to which an image can be applied using an image transfer medium and the second type of image receiving tape is of the type to which an image can be directly applied.

4. A tape printing apparatus as claimed in any preceding claim,

wherein said print head is activated in pulses, with a single activation pulse being provided for each group of print information in the first mode of operation and two activation pulses being provided for each group of print information in said second mode.

5. A tape printing apparatus as claimed in one of claims 1 to 3, wherein said print head is activated in pulses, with a double activation pulse being provided for each group of data in the first mode of operation and four activation pulses being provided for each group of data in said second mode.

6. A tape printing apparatus as claimed in claim 4 or 5, wherein the control means defines the length of said pulses, whereby the length of each pulse in said first mode of operation is different from the length of each pulse in said second mode of operation.

7. A tape printing apparatus as claimed in claim 6, wherein the length of each activation pulse of the print head is longer in the second mode of operation than in said first mode of operation.

8. A tape printing apparatus as claimed in any of claims 4 to 7, wherein the length of the activation pulses used in said first and/or second modes of operation are selected in accordance with the properties of the image receiving tape types and/or the properties of the tape printing apparatus.

9. A tape printing apparatus as claimed in claim 8, wherein the length of the activation pulse used in said first and/or second mode of operation is selected in accordance with the resistance of the print head.

10. A tape printing apparatus as claimed in any preceding claim, wherein said image receiving tape is moved relative to said print head between successive activations of the print head.

11. A tape printing apparatus as claimed in claim 10, wherein said image receiving tape is moved relative to said print head, between said successive activations of printing elements of said print head for a given group of print information by a distance of between 10 to 35% and preferably 25% of the printed pixel pitch, on said image receiving tape, said pixel pitch being measured in the direction of movement of the tape.

12. A tape printing apparatus as claimed in claim 10 or 11, wherein a dc motor is provided for continuously moving said image receiving tape relative to said print head.

13. A tape printing apparatus as claimed in claim 12, wherein means for monitoring the speed of the motor are provided, said monitoring means being connected to said control means to control the sequential printing of said groups of print information in dependence on the speed of rotation of the motor.

14. A tape printing apparatus as claimed in claim 4 or any claim appended thereto, comprising selecting means for selecting a value or values for the length of the said activation pulses in said first and/or second mode of operation from a range of possible values for the length of said pulses, said selecting means being coupled to said control means which is operable to control the operation of said print head such that printing elements of the print head are activated for the selected pulse length in the first and/or second modes of operation.

15. A tape printing apparatus as claimed in claim 14, wherein said selecting means comprises a plurality of open circuit links, at least one of said links being short circuited, each possible selection of one or more short circuited links being representative of a value for the pulse length in said first and/or second modes.

16. A tape printing apparatus as claimed in claim 15, wherein said links are provided between the existing rows or columns of

a keyboard matrix of a keyboard for inputting an image to be printed on said image receiving tape and an additional dedicated column or row line, which intersects said existing rows or columns.

17. A tape printing apparatus as claimed in claim 14, 15 or 16, wherein said selecting means are operable to set a first value for the pulse length in the first mode of operation and to set separately a second value for the length of the pulse in the second mode.

18. A tape printing apparatus as claimed in claim 17, wherein said selecting means sets the pulse length for one mode in dependence on the pulse length of the other mode.

19. A tape printing apparatus as claimed in any preceding claim, wherein switch means are provided for switching between said modes, said switch means being operable to provide a signal to the control means to indicate whether the print head is to be controlled to have the first mode of operation or the second mode.

20. A tape printing apparatus as claimed in claim 18 or 19, wherein said switch means are provided in said means for receiving the supply of image receiving tape, said switch means having one position when the image receiving tape is of the first type and a second position when said tape is of the second type.

21. A tape printing apparatus as claimed in claim 18 or 19, wherein said switch means is manually operated by a user of the tape printing apparatus.

22. A tape printing apparatus as claimed in claim 18 or 19, wherein said switch means are automatically operated on insertion of said supply of image receiving tape.

23. A tape printing apparatus for printing an image on an image

receiving tape comprising:

means for receiving a supply of image receiving tape, said image receiving tape being of a first type of material to which an image can be directly applied by a thermal print head or a second type of material to which an image can be applied by the thermal print head using an image transfer medium;

a thermal print head for printing an image on said image receiving tape; and

control means for controlling the operation of said print head, wherein said thermal print head has a first mode of operation when said image receiving tape is of the first type of material and a second, different mode of operation when said image receiving tape is of the second type of material.

24. A tape printing apparatus as claimed in claim 23, in which said control means is operable to activate printing elements of said print head in accordance with print information defining the image to be printed, said print information comprising a plurality of groups of data to be printed sequentially on a group-by-group basis, said control means being operable to control the print head to have a first mode of operation, if said image receiving tape of the first type, in which the printing elements are activated a first predetermined number of times for each group of data and a second mode of operation, if the image receiving tape is of the second type, in which the printing elements are activated a second predetermined number of times for each group of data, the first predetermined number differing from the second predetermined number.

25. A method of printing an image on an image receiving tape comprising the steps of:

inputting data defining an image to be printed on said image receiving tape;

generating print information to control a print head from said input data, said print information comprising a plurality of groups of data, said print head having a plurality of printing elements;

passing said groups of data sequentially to said print head; and

printing said groups of data adjacent one another on said image receiving tape, wherein the printing elements of the print head are activated a first predetermined number of times for each group of data, if the image receiving tape is of a first type and, if the image receiving tape is of a second type, the printing elements are activated a second, different predetermined number of times for each group of data.

The Patent Office

35

Application No: GB 9622282.3
Claims searched: 1-24

Examiner: Gary Williams
Date of search: 5 March 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B6F: FAM,FJH,FKD,FBH

Int Cl (Ed.6): B41J:2/315,2/32,2/325,3/407

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2194487 A	(RICOH) See page 7,line 64 - page 8,line 1	23
X	EP 0512168 A1	(BROTHER) See col.2,line 50 - col.3,line 3 & col.8,line 56 - col.9,line 54	23
X	EP 0367237 A2	(CANON) See Figs.1&5, col.8,line 44 - col.11,line 7	1,2,3,19, 20-25
X	US 5070342 A	(BROTHER) See col.3,lines 52-68, col.13,line 24 - col.16,line 63, col.17,lines 62-68	1,23-25
X	US 4511903 A	(TOKYO ELECTRIC) See col.2,lines 10-29	23

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.